Notice No.2

Rules and Regulations for the Classification of Offshore Units, July 2022

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: December 2022

Amendments to	**Effective date**	**IACS/IMO implementation (if applicable)**
Part 1, Chapter 1, Section 9	Corrigendum	N/A
Part 1, Chapter 2, Section 3	1 January 2023	N/A
Part 1, Chapter 3, Sections 2 & 9	1 January 2023	N/A
Part 3, Chapter 7, Section 2	1 January 2023	N/A
Part 3, Chapter 11, Section 1	1 January 2023	N/A
Part 4, Chapter 3, Section 4	1 January 2023	N/A
Part 4, Chapter 4, Section 3	1 January 2023	N/A
Part 4, Chapter 6, Sections 3, 4, 7, 8 & 9	1 January 2023	N/A
Part 6, Chapter 2, Section 7	1 January 2023	N/A
Part 7, Chapter 1, Section 2	1 January 2023	1 January 2023
Part 7, Chapter 3, Section 3	1 January 2023	1 January 2023
Part 10, Chapter 1, Sections 5 & 6	1 January 2023	N/A
Part 10, Chapter 2, Sections 3 & 6	1 January 2023	N/A
Part 12, Chapter 1, Sections 19 & 23	1 January 2023	N/A

Part 1, Chapter 1
General Regulations

■ *Section 9*
Sanctions Compliance

9.1 When a ~~ship~~ vessel has been operated in breach of applicable sanctions laws, or where LR cannot continue to provide services without being in breach of applicable sanctions laws, LR may withdraw or suspend class.

Part 1, Chapter 2
Classification Regulations

■ *Section 2*
Definitions, characters of classification and class notations

2.9 Descriptive notes/Supplementary Character

2.9.8 **READY().** When satisfactory preparation has been made at the time of completion and delivery or refit of the vessel for a structure, a system or equipment which is subject to classification then this descriptive note, showing the associated classification characters within brackets will, at the Owner's request, be entered in the *Register Book* preceded by the word **READY**, e.g. **READY(RIGGING)**.

If the asset is **READY()** for multiple notations the descriptive note will appear as **READY(notation 1, notation 2)**.

Satisfactory preparation includes but is not limited to:
- Clear and comprehensive definition of the intended structure, system or equipment in line with classification requirements.
- The interface boundary delimiting the physical and operational boundary is clearly defined and sets out the components that are omitted during construction.
- A list of interface requirements even though these are not typically part of the requirements for classification. These are to be accompanied by technical solutions or reference to design features that show how each of the interface requirements is met. The interface location and requirements are to be jointly developed by the Client and LR.
- Interface requirements may be quantitative or qualitative. Suitable safety criteria are to be defined.
- The design of the asset fully incorporates the intended structure, system or equipment. This is to be verified during appraisal.
- As far as practicable, the fitting of the omitted structure, system or equipment is not to depend on the removal of other structures, systems or equipment but should only depend on the addition of the omitted structure, system or equipment.

Each of the design documents which are required for classification is assessed as if the structure, system or component is fitted. If details of the system are unknown at the time of application for the descriptive note, design constraints may, on occasion, be confirmed by an Approval in Principle (AiP). This course of action will be captured in the descriptive note in the following manner: **READY(NOTATION(A))** where A indicates the AiP.

Additional interface documents are assessed with particular attention to the practicality and feasibility of the boundary definition.

Construction is carried out as per appraised plans omitting the structure, system or equipment set out by the interface boundary.

The **READY()** descriptive note is awarded based on the documented verification of the above requirements. Appraisal and Survey by LR will be carried out as far as practicable for the interface arrangements and, if applicable, the partially installed system.

Notations are included in the list of those eligible for the **READY()** descriptive note at the discretion of LR.

Part 1, Chapter 3
Periodical Survey Regulations

■ *Section 2*
Annual Surveys - Hull and machinery requirements

2.3 Machinery

2.3.23 Where Lithium-Ion battery system installations with total system capacity exceeding 20 kWh are used as a power source for essential or emergency systems, testing of the following is to be conducted annually so far as is practicable:

- manual and automatic safety functions; and
- monitoring and control functions.

2.3.24 The safety aspects of spaces or compartments containing Lithium-Ion batteries used as a power source for essential or emergency systems are to be examined as applicable to the installation. This could include examinations of:
(a) structural fire protection;
(b) fixed fire detection;
(c) fixed firefighting system(s);
(d) ventilation and associated dampers;
(e) off-gas detection, exhaust and/or extraction arrangement;
(f) integrity of battery crates, trays, boxes, shelves and other structural parts;
(g) battery cooling arrangement;
(h) electrical power cabling, switchgear and converters; and
(i) EEBD (emergency escape breathing device) and means of escape.

■ *Section 9*
Electrical equipment

9.2 Complete Surveys

9.2.15 Where batteries with charging power higher than 2kW provide the source of power for any essential or emergency services, their installation, including charging and ventilation arrangements, is to be examined.

9.2.16 Sufficient battery capacity shall be verified for Lithium-Ion battery system installations used as the primary power source for emergency systems.

9.2.17 Where Lithium-Ion batteries with total system capacity exceeding 20 kWh are used as the primary power source for essential or emergency systems, a test of all required monitoring and safety functions shall be carried out.

9.2.18 A test of the safety functions in spaces or compartments containing Lithium-Ion batteries with total system capacity exceeding 20 kWh used as power source for essential and emergency services shall be carried out, i.e., fire detection and extinguishing, gas detection, ventilation etc. as applicable to the installation.

9.2.19 The safety aspects of spaces or compartments containing Lithium-Ion batteries used as a power source for essential or emergency systems are to be examined as applicable to the installation. This could include examinations of:
(a) structural fire protection;
(b) fixed fire detection;
(c) fixed firefighting system(s);
(d) ventilation and associated dampers;
(e) off-gas detection, exhaust and/or extraction arrangement;
(f) integrity of battery crates, trays, boxes, shelves and other structural parts;
(g) battery cooling arrangement;
(h) electrical power cabling, switchgear and converters; and
(i) EEBD (emergency escape breathing device) and means of escape.

Part 3, Chapter 7

Drilling Plant Facility

■ *Section 2*
Structure

2.5 Water towers

2.5.5 Wind loads are to be calculated in accordance with LR's ~~Code for Lifting Appliances in a Marine Environment (hereinafter referred to as LAME Code)~~ *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems*, as appropriate, or a recognised Code or Standard, *see Pt 12, Ch 1 Recognised Codes and Standards*.

2.6 Flares structures

2.6.7 Wind loads are to be calculated in accordance with LR's ~~LAME Code~~ *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems*, as appropriate, or a recognised Code or Standard, *see Pt 12, Ch 1 Recognised Codes and Standards*.

2.7 Lifting appliances

(Part only shown)
2.7.1 Lifting appliances shall, as a minimum, meet the requirements of the following Standards and are to comply with LR's ~~LAME Code~~ *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems*, as appropriate, and where applicable, PUWER Reg 4 and LOLER Reg 5. *See also Pt 3, Ch 11 Lifting Appliances and Support Arrangements*.

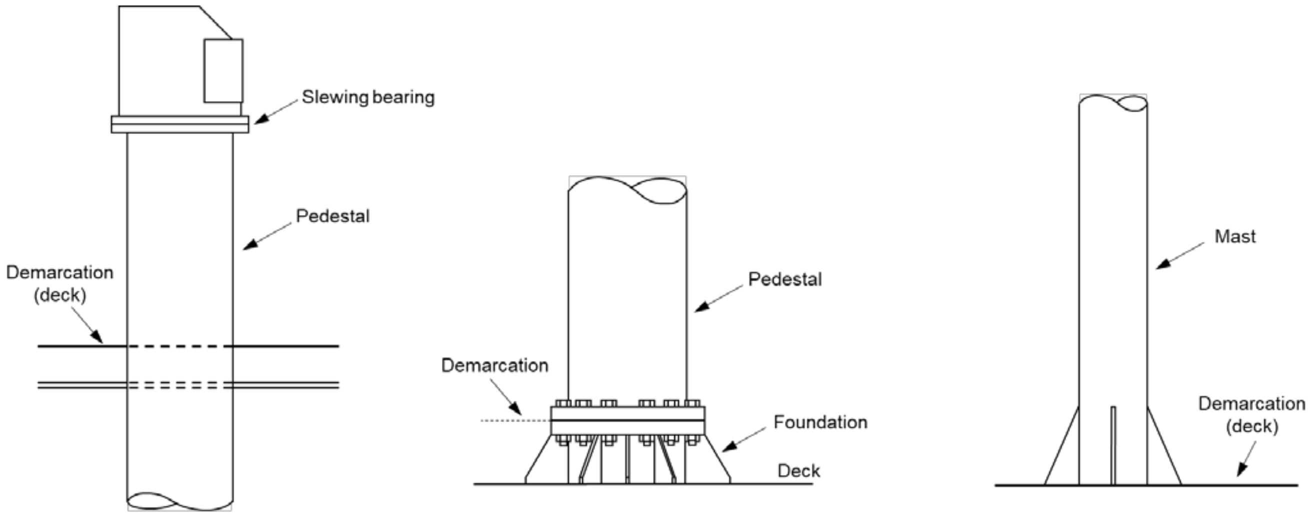
Part 3, Chapter 11
Lifting Appliances and Support Arrangements

■ *Section 1*
Rule application

1.1 General

1.1.1 Lifting appliances are to be built in accordance with the requirements of LR's ~~Code for Lifting Appliances in a Marine Environment~~ *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems*, as applicable.

1.1.6 ~~Masts, derrick posts, crane pedestals and similar supporting structures for equipment~~ Lifting appliance pedestals and foundations that are welded to the supporting hull structures are classification items, and the scantlings and arrangements are to comply with the additional requirements of this Chapter, *see Figure 11.1.1 Classification items and applicability of LR's requirements for lifting appliance pedestals and foundations*.



(a) Classification items:
- pedestal up to and excluding the slewing bearing
- classed lifting appliance

(b) Classification items:
- foundation connecting the pedestal and the deck
- classed lifting appliance

(c) Classification items:
- mast, derrick post, king post or similar structure up to and excluding the first non-welded component
- any associated brackets that are welded to the deck
- classed lifting appliance

Note 1: Items below the demarcation are to comply with LR's *Rules and Regulations for the Classification of Offshore Units*.
Note 2: Items above the demarcation are to comply with LR's *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems*, as applicable.

Figure 11.1.1 Classification items and applicability of LR's requirements for lifting appliance pedestals and foundations

1.2 ~~Masts, derrick posts and crane pedestals~~ Lifting appliance pedestals and foundations

1.2.1 The scantlings of ~~masts and derrick posts, intended to support derrick booms, and of crane pedestals~~ lifting appliance pedestals and foundations (such as masts, derrick posts and crane pedestals) are to comply with the requirements of LR's ~~*Code for Lifting Appliances in a Marine Environment* (hereinafter referred to as LAME Code)~~*Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems,* as applicable, *see Figure 11.1.1 Classification items and applicability of LR's requirements for lifting appliance pedestals and foundations*.

1.2.2 In addition to the information and plans requested in LR's ~~LAME Code~~ *Code for Lifting Appliances in a Marine Environment* or LR's *Code for Offshore Personnel Transfer Systems,* as applicable, the following details are to be submitted:

(a) Details of ~~deckhouses or other supports~~ the supporting hull structures for ~~the masts, derrick posts or crane pedestals~~ lifting appliance pedestals and foundations, together with details of the attachments to the hull structure.

(b) Details of any reinforcement or additional supporting material fitted to the hull structure in way of ~~the mast, derrick post or crane pedestal~~ lifting appliance pedestals and foundations.

1.2.3 ~~Masts, derrick posts or crane pedestals~~ Lifting appliance pedestals and foundations are to be efficiently supported and, in general, are to be carried through the deck and satisfactorily ~~scarfed~~integrated into transverse or longitudinal bulkheads, or equivalent structure. Alternatively, ~~the mast, derrick posts or crane pedestals~~ lifting appliance pedestals and foundations may be carried into a ~~deckhouse or equivalent structure, in which case the house is to be~~ supporting structure of ~~substantial construction~~adequate strength. Proposals for other support arrangements will be specially considered.

1.2.4 Deck plating and underdeck structure are to be reinforced under ~~masts, derrick posts and crane pedestals~~ lifting appliance pedestals and foundations. Where the deck is penetrated the deck plating is to be suitably increased locally.

1.3 Lifting appliances

1.3.1 Offshore units fitted with lifting appliances built in accordance with the classification requirements of LR's *Code for Lifting Appliances in a Marine Environment* ~~in respect of structural and machinery requirements~~ or LR's *Code for Offshore Personnel Transfer Systems,* as applicable, will be eligible to be assigned special features class notations as listed in *Table 11.1.1 Special features class notations associated with lifting appliances*. The notation will be retained so long as the appliances are found upon examination at the prescribed surveys to be maintained in accordance with LR's requirements.

Part 4, Chapter 3
Structural Design

■ *Section 4*
Structural design loads

4.9 Wave loads

(Part only shown)
4.9.7 The following methods may be used for load estimation:

(a) The forces on structural elements with dimensions less than 0,2 of the wave length subject to drag/inertia loading due to wave and current motions can be calculated from the Morison's equation:

~~$F = 0,5C_{\mathrm{D}} \rho A_{\mathrm{u}} \mathrm{IuI} + \mathrm{C}_{\mathrm{M\,r}\rho} \mathrm{V\,a}$~~

$$F = 0{,}5\rho C_{\mathrm{D}} A u|u| + \rho C_{\mathrm{M}} V a$$

where

~~IuI = modulus of u~~

(c) General values of hydrodynamic coefficients may be used in the Morison's equation for the calculation of overall loading on the structure, namely:

- For circular cylinders, C_{M} is to be not less than 1,7.
- The recommended C_{D} and C_{M} for the members of a lattice leg are given in *Pt 4, Ch 4, 3.9 Unit in the elevated position*.

Part 4, Chapter 4
Structural Unit Types

■ *Section 3*
Self-elevating units

3.1 General

3.1.2 A self-elevating unit is a floating unit which is designed to operate as a ~~sea bed-stabilised~~ seabed-stabilised unit in an elevated mode, *see Pt 1, Ch 2, 1 Conditions for Classification.*

3.1.4 The structural analysis and determination of primary scantlings are to be on the basis of distribution of loadings expected in all modes of operation and the relevant combinations of global and local loadings.

3.1.5 A self-elevating unit may be designed for the site-specific environmental conditions of one or more geographical locations. Where the unit is intended for operation at more than one location, the most severe design environmental conditions are to be considered in the design. The environmental limits for operating and survival conditions should be defined in the Operations Manual.

3.1.6 For a self-elevating unit designed to leave the area of operation due to extreme weather conditions such as cyclones, ice, etc., the limiting environmental criteria for disconnection are to be defined in the design basis. The specific procedure for site installation and the re-floating condition is to be stated in the Operations Manual. For units operating in regions subject to sea ice and icebergs, the requirements shall be supplemented with the provisions relating to ice actions and specially agreed by LR.

3.1.7 The structural design of self-elevating units should consider possible changes in topside weights, environmental conditions, leg penetration, water depth, soil fixity and air gap during long-term operation in the elevated condition. A sufficient weight allowance and variable centre of gravity may be considered for the design.

3.1.8 Site assessment for soil foundation capacity is not within the scope of classification. It is the Owner's responsibility for safe operation.

3.1.9 If the operation of a self-elevating unit is of limited durations, applicable seasonal data may be used for the months under consideration.

3.1.10 Where appropriate, the influence of earthquake loading on self-elevating units is to be fully accounted for in the design in relation to the particular site conditions. Seismic design and seismic criteria should be considered in accordance with the latest revision of ISO19901-2 *Petroleum and natural gas industries – Specific requirements for offshore structures – Part 2: Seismic design procedures and criteria*.

3.2 Air gap

Existing paragraph 3.2.1 has been deleted in its entirety and replaced with the below:

3.2.1 An air gap is defined as the clearance between the underside of the hull structure and the highest predicted design wave crest superimposed on the maximum storm surge height over the highest astronomical tide in the elevated position. The air gap and wave crest above the still water level is defined in *Figure 3.2.1 Air gap*. The hull elevations should also account for any settlement due to extreme or abnormal storm events.

3.2.2 The maximum storm surge height and the highest astronomical tide should be based on a design return period at the intended operating location of not less than 50 years for mobile units and 100 years for fixed installations.

3.2.3 The minimum clearance is not to be less than 1,5 m. Calculations, model test results or prototype reports are to be submitted for review. In cases where the unit is designed without an adequate air gap, the scantlings of the hull and leg structures are to be designed for wave impact forces and green seas. If any part of the hull structure is waterborne during operation, the scantlings are to be specially considered with site specific wave and current loads.

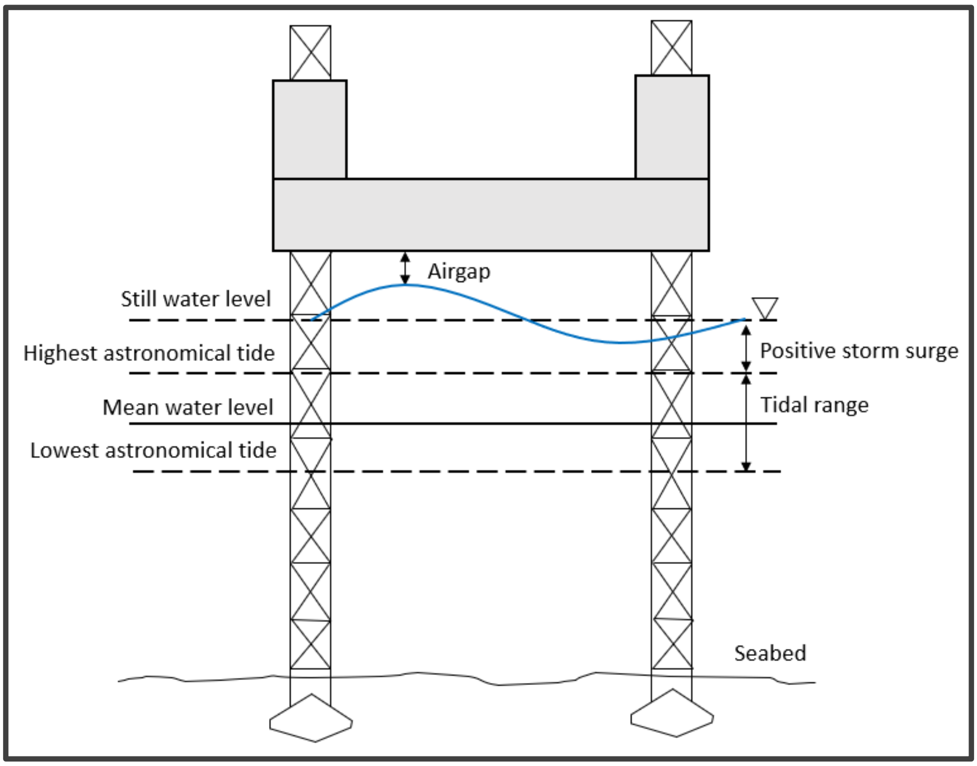


Figure 4.3.1 Air gap

3.3 Structural design

3.3.1 The structure is to be designed to withstand the static and dynamic loads imposed upon it ~~in transit, installation, re-floating and elevated conditions.~~ in all modes of operation including:

- Transit condition;
- Site Installation condition (jacking condition and pre-load condition);
- Operating condition;
- Survival condition; and
- Re-floating condition.

All relevant distributions of gravity, ~~and variable~~ functional ~~loads~~ and environmental loads are to be considered~~, as are stresses due to the overall and local effects~~, *see Pt 4, Ch 3, 4 Structural design loads*.

Existing paragraph 3.3.2 has been deleted in its entirety and replaced with the below:

3.3.2 For self-elevating units in transit condition, only wet transits, i.e., field and ocean transits, are to be considered in the structural design. Dry transit on a heavy lift vessel, including planning and procedures, sea-fastenings, and marine operations, is out of the scope of classification and normally covered by marine warranty for the operation. After the dry tow a survey may be carried out at the discretion of LR prior to installation of the unit. The survey includes a visual inspection and NDT of the leg structures near the top of jack-house during the dry tow and hull structures subjected to slamming impact during the dry tow on the carrier vessel. The detailed scope is to be agreed with the attending Surveyor.

Existing paragraph 3.3.3 has been deleted in its entirety and replaced with the below:

3.3.3 The pre-load condition is to be analysed for the structural design as self-elevating units are pre-loaded in the elevated position to ensure that the soil can withstand the maximum expected footing reaction without experiencing additional leg penetration, sudden punch-through, or soil failure. The pre-load procedure and the limiting environmental conditions are to be specified in the design basis and the Operations Manual. The environmental conditions for the jacking condition are to be used to assess the jacking capacity of the unit, *see Table 4.3.1 Design loading conditions*.

Existing paragraph 3.3.4 has been deleted in its entirety and replaced with the below:

3.3.4 The operating and survival conditions are to be investigated separately to provide for the mode of operation being changed from operating to survival mode due to unfavourable weather forecast. The limits of operational loading conditions may be dependent on the specific drilling or production operations.

Existing paragraphs 3.3.5 and 3.3.7 have been deleted in its entirety and replaced with the below:

3.3.5 For normal operating and storm survival conditions, variations in the hull elevation, location of the cantilever and drill floor substructure, deck load, etc. are to be considered in the design.

3.3.6 Global and local strength analyses for self-elevating units shall be performed for the following objectives:

- To determine the correct response with respect to displacement, base shear and overturning moment;
- To correctly simulate the linear and non-linear (P-Δ effect) characteristics of legs, leg to hull connections, and leg to spudcan connections;
- To ensure adequate strength of the hull, the legs and the spudcan; and
- To ensure adequate capacity of the jacking and the fixation system, where applicable

3.3.7 Global strength analysis for the elevated condition is to consider the following design loads.

- Gravity and functional loads;
- Environmental loads (wind, wave, current, snow and ice, etc.);
- Dynamic amplification due to wave loads (acting with current); and
- P-Δ effects due to hull lateral deflections including Euler's non-linear amplification factor and initial leg inclination.

3.3.8 Dynamic structural responses due to environmental loading are to be investigated because the natural period of a self-elevating unit in the elevated condition is typically within the range of wave period, so that the effect of dynamic amplification is to be taken into account in both strength and fatigue analyses. Natural period calculations for the elevated condition are to be submitted for review. The three highest natural periods corresponding to surge (longitudinal), sway (transverse) and yaw (torsional rotation) motions are to be included.

3.3.9 All modes of operation are to be investigated and the relevant design load combinations defined in *Pt 4, Ch 3, 4.3 Load combinations* are to be complied with. The design loading conditions applicable to a self-elevating unit are given in *Table 4.3.1 Design loading conditions*.

Table 4.3.1 Design loading conditions

<table>
<tr><th rowspan="2">Mode of operation
(*see* Note 4)</th><th colspan="4">Applicable loading condition (*see* Note 1)</th></tr>
<tr><th>(a)</th><th>(b)</th><th>(c)
(*see* Note 2)</th><th>(d)
(*see* Note 2)</th></tr>
<tr><td>Site installation (*see* Note 3) and re-floating</td><td>X</td><td>X</td><td></td><td></td></tr>
<tr><td>Operating</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Survival</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Transit</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td colspan="5">NOTES</td></tr>
<tr><td colspan="5">1. For definition of loading conditions (a) to (d), *see Pt 4, Ch 3, 4.3 Load combinations.*</td></tr>
<tr><td colspan="5">2. For loading conditions (c) and (d) as applicable to a self-elevating unit, *see Pt 4, Ch 4, 3.3 Structural design 3.3.114* ~~to *Pt 4, Ch 4, 3.3 Structural design 3.3.6*~~. Loading condition (d) is to be considered with a minimum 1-year return storm.</td></tr>
</table>

3. Site installation includes jacking and preload conditions. Site installation condition may be considered as load case (a) with the environmental limits specified by the Operator or 1-year return storm. Loadings associated with the maximum storm cases may be considered as load case (b).

4. The following limiting environmental conditions for the global strength analysis are to be specified in the structural design basis:

- Wave height and a range of wave periods, *see* *Pt 4, Ch 3, 4.9 Wave loads*.
- Wind velocity (1 min. mean) and wind profile, *see* *Pt 4, Ch 3, 4.6 Wind loads*.
- Current velocity and current profile, *see* *Pt 4, Ch 3, 4.7 Current loads*.
- Water depth, air gap, and leg penetration depth (for elevated condition only).

3.3.10 The permissible stresses and buckling capacity of all structural members contributing to the global and local strength are to be in accordance with *Pt 4, Ch 5 Primary Hull Strength* and the minimum local scantlings of the unit are to comply with the requirements of *Pt 4, Ch 6 Local Strength*.

3.3.11 For accidental assessments, the general requirements for investigating accidental loads are defined in *Pt 4, Ch 3, 4.16 Accidental loads*.

(a) In transit conditions, collision loads against the hull structure will normally only cause local damage to the hull structure and consequently loading condition (c) in *Table 4.3.1 Design loading conditions* need not be investigated from the overall strength aspects.

(b) In the elevated position, accidental collision to the legs by a supply vessel is to be considered in the design and the unit is to be capable of absorbing the energy of impact in association with environmental loads corresponding to the appropriate one-year storm condition. For legs of the lattice type, damaged chords or bracings should normally be assumed non-effective in the global strength analysis.

(c) In general, for loading condition (c) in *Pt 4, Ch 4, 3.3 Structural design 3.3.3*, the level of impact energy absorbed by the local leg structure is not to be taken as less than 2 MJ. If the unit is only to operate in protected waters, as defined in *Pt 1, Ch 2, 2.4 Class notations (hull/structure)*, the level of impact energy absorbed by the local leg structure may be reduced, but should not be less than 0,5 MJ. Collision loads by a supply vessel will, in general, only cause local damage to one leg, but the possibility of progressive collapse and overturning stability of the unit should be considered in the design calculations.

3.3.12 In fatigue assessments, fatigue damage due to cyclic loading is to be considered for transit and elevated conditions. Fatigue damage is considered accumulative throughout the unit's design life. The extent of the fatigue analysis will be dependent on the mode and area of operations, *see* *Pt 4, Ch 5, 5 Fatigue design*.

3.4 Hull structure

3.4.1 The hull is to be considered as a complete structure having sufficient strength to resist all induced stresses while in the elevated position, including the pre-load condition, and supported by its legs. ~~All fixed and variable loads are to be distributed, by an accepted method of rational analysis, from the various points of application to the supporting legs. The scantlings of the hull are then to be determined consistent with this load distribution.~~

Existing paragraph 3.4.2 has been deleted and replaced with the below:

3.4.2 All fixed, variable and environmental loads are to be distributed and combined, by an accepted method of rational analysis, from the various points of application to the supporting legs. The scantlings of the hull are then to be determined consistent with these load distributions.

3.4.3 Due account must be taken of loadings induced in the transit condition from external sea heads, variable deck loads and inertia forces on the legs. The effects of different ballast distribution are to be adequately considered for global and local responses in the design of hull structure.

3.4.4 Hull integration structures in way of jack-houses (jackcases), fixation systems, topsides, drill floor substructure, crane pedestals, moorings, and other concentrated loads are to be analysed by direct calculations in compliance with *Pt 4, Ch 5 Primary Hull* and *Pt 4, Ch 6 Local Strength*, where applicable.

3.5 Deckhouses

3.5.3 The structural design, installation, and sea-fastenings of offshore portable containers intended for storage or temporary accommodations are not within the scope of classification. They are to comply with applicable codes and standards. However, connections to the deck and the supporting hull structures are to be analysed in compliance with *Pt 4, Ch 5 Primary Hull*.

3.6 Structure in way of jacking or elevating arrangements

3.6.1 Load carrying members in the jack-houses and frames which transmit loads between the legs and the hull are to be designed for the maximum design loads in all loading conditions and are to be so arranged that loads transmitted from the legs are properly diffused into the hull structure. ~~The scantlings of jackhouses are not to be less than required for deckhouses in accordance with *Pt 4, Ch 6, 9 Superstructures and deck-houses*.~~

3.6.2 The scantlings of jack-houses are not to be less than required for deckhouses in accordance with *Pt 4, Ch 6, 9 Superstructures and deck-houses*.

3.6.3 Both elevated and transit conditions are to be analysed for the design of jack-houses and supporting hull structures with respect to strength and fatigue. In the transit condition, inertia loads due to wave motions in combination with wind induced bending moments in the legs will be transferred to the jack-houses and the supporting hull structures. Local detailed structural analysis is to be performed and submitted for review.

3.7 Leg wells

3.7.1 The scantlings and arrangements of the boundaries of leg wells are to be specially considered and the structure is to be suitably reinforced in way of leg guides, taking into account the maximum forces imposed on the structure. ~~The minimum scantlings of leg wells are to comply with *Pt 4, Ch 6, 3.3 Self-elevating units*.~~

3.7.2 The minimum scantlings of leg wells are to comply with *Pt 4, Ch 6, 3.3 Self-elevating units*.

3.8 Leg design

3.8.2 Where legs are fitted with independent footings, proper consideration is to be given to the leg penetration of the sea bed and the end fixity of the leg in the elevated condition as defined in *Pt 4, Ch 4, 3.15 Foundation fixity*.

3.8.3 Leg scantlings are to be determined in accordance with a method of rational analysis and calculations are to be submitted for ~~consideration~~ review, see *Pt 4, Ch 3, 3 Structural idealisation*.

3.8.4 For lattice type legs, the slenderness ratio of the main chord members between joints is not to exceed 40, or two thirds of the slenderness ratio of the leg column as a whole, whichever is the lesser, unless it can be shown that a calculation taking into account beam-column effect, joint rigidity and joint eccentricity justifies a higher figure.

3.8.5 For strength and fatigue analyses, the corrosion rate of legs is to be deducted from gross scantling, *see* *Table 3.7.1 Corrosion rate for one side of structural member* in *Pt 4, Ch 3, 7.4 Scantling compliance*.

3.8.6 Individual tubular and non-tubular members and joints in the lattice type legs, including conical transitions, may be designed in accordance with recognized Codes and Standards and the safety factors given in *Pt 4, Ch 5 2 Permissible stresses*.

3.8.7 Shell type leg structures are to be in compliance with the requirements of *Pt 4, Ch 5 2 Permissible stresses.*

3.8.8 Fatigue analysis due to cyclic loading is to be performed for the integrity of legs for transit and elevated conditions, *see* *Pt 4, Ch 5, 5 Fatigue design*. Fatigue critical locations in the legs should include the following:

- Leg joints in way of the fixation system;
- Leg joints in way of the upper and lower guides;
- Leg joints in way of the splash zone; and
- Leg joints at lower part of the leg.

3.8.9 For self-elevating units permanently at a fixed location, leg structures in way of the splash zone, leg structures and spudcans under the seabed are not considered accessible for inspection and repair unless special arrangements are made in the planned survey programme approved by LR.

3.9 Unit in the elevated position

3.9.1 When computing leg stresses with the unit in the elevated position, the maximum overturning load and maximum shear load on the unit, using the most adverse combination of applicable variable loadings together with the environmental design loadings, are to be considered with the following criteria:

(a) **Wave forces:** Values of drag coefficient, C_D, and inertia coefficient, C_m, vary considerably with Reynolds number, R_n, and Keulegan-Carpenter number, N_k, and are to be carefully chosen to suit the individual circumstances. In calculating the wave forces using acceptable wave theories, the hydrodynamic coefficient values to be used are given below. ~~as given in *Pt 4, Ch 4, 3.9 Unit in the elevated position 3.9.1.(a).(i)* to *Pt 4, Ch 4, 3.9 Unit in the elevated position 3.9.1.(a).(iii)* for the hydrodynamic coefficients C_D and C_m~~, ~~for non-tubular members of the leg chords may be used essentially in the drag dominated regime with post-critical Rn and high N_k. Otherwise more detailed information based on tests or published data is to be used.~~ The effect of marine growth and other appurtenances (e.g., anodes) to the legs should be considered in the wave force calculation.

(i) Tubular members:

Surface condition	Drag coefficient, C_D	Inertia coefficient, C_M
Smooth (above MWL+2 m)	0,65	2,0
Rough (below MWL+2 m)	1,0	1,8
Note *1.* C_d and C_m are considered at post-critical Reynolds number and high Keulegan-Carpenter number. **Note** *2.* Design assumptions for marine growth is to be stated in the design basis. Marine growth thickness should be at least 12,5 mm (25 mm in total) for all members below MWL+2 m unless site specific data is available. Marine growth on the teeth of racks may normally be ignored.		

Note *3*. These hydrodynamic coefficients are valid for tubulars less than 1,5 m in diameter.

Note *4*. MWL refers to the Mean Water Level.

(ii) Cylindrical chord members with protruding racks: ~~Drag coefficient~~

~~$CD = Cd + (DE - DC)/DC + (2 \sin \theta)$~~

~~For marine fouled members, *CD* calculated is to be factored by 1,2. Inertia coefficient,~~
~~$CM = Cm\ (Ag/AC)$~~
~~where~~
~~*C*d = the drag coefficient used for a smooth cylinder member~~
~~*C*m = the inertia coefficient used for a cylinder member~~
~~*D*E = pitch distance of the racks~~
~~*D*C = nominal diameter of the cylindrical part of the member~~
~~*A*g = the cross-sectional area of the member~~
~~*A*c = the cross-sectional area of the cylindrical part of the member~~
~~= the angle between the flow direction and the central line of the cross-section along the racks~~

Surface condition	Drag coefficient, C_D	Inertia coefficient, C_M
Smooth	0,65 for $\theta \leq 20°$ $0{,}65 + \left(C_{D1}\frac{W}{D} - 0{,}65\right)\sin^2\left[\frac{9}{7}(q - 20°)\right]$ for $20° < \theta \leq 90°$	2,0 for all directions
Rough	1,0 for $\theta \leq 20°$ $1{,}0 + \left(C_{D1}\frac{W}{D} - 1{,}0\right)\sin^2\left[\frac{9}{7}(q - 20°)\right]$ for $20° < \theta \leq 90°$	1,8 for all directions

where

W = rack width

D = distance between split tube chords. For chords with rack teeth welded to the outer surface the nominal diameter may be used.

C_{D1} = drag coefficient for wave flow normal to the rack (θ = 90º)

= 1,8 for $W / D \leq 1{,}2$

= 1,4 + $W / 3D$ for $1{,}2 < W / D \leq 1{,}8$

= 2,0 for $1{,}8 < W / D$

(iii) Triangular chord members:

~~Drag coefficient, for smooth triangular members:~~
~~C_D = 1,6 θ = 0°~~
~~C_D = 1,4 θ = 45°~~
~~C_D = 1,8 θ = 90°~~
~~C_D = 1,7 θ = 135°~~
~~C_D = 1,3 θ = 180°~~
~~For marine fouled members, the C_D values are to be factored by 1,2.~~
~~Inertia coefficient, C_m = 1,4~~
~~where~~
~~θ = Relative approach angle of flow, 0° being towards the backplate and to be counted clockwise.~~

Surface condition	Drag coefficient, C_D	Inertia coefficient, C_M
	$C_{Dpr}\ (q)\ \frac{D_{pr}}{D}$	2,0 for all directions

where

C_{Dpr} (q) = drag coefficient referenced to the projected diameter. Linear interpolation is to be applied for intermediate wave flow.

1,7	for q = 0°
1,95	for q = 90°
1,4	for q = 105°
1,65	for q = 180° - q_0
2,0	for q = 180°

D_{pr} = projected diameter of the chord

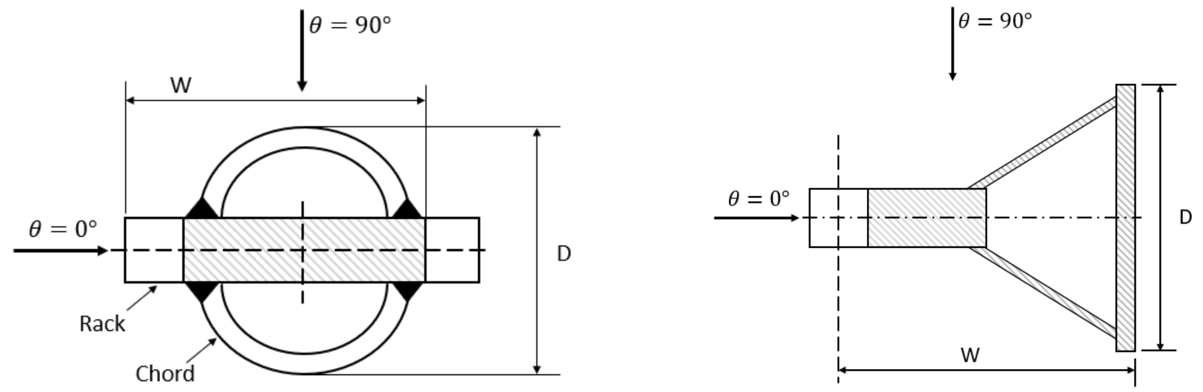
$D\cos(q)$ for $q < q_0$

$W\sin(q) + 0{,}5D\,|\cos(q)|$ for q_0 £ $q < 180 - q_0$

$D\,|\cos(q)|$ for $180 - q_0$ £ q £ 180

q_0 = angle where half the backplate is hidden, $\tan^{-1}(\frac{D}{2W})\ q_0$

(iv) Other shapes of non-tubular members: C_D and C_m values should be assessed based on the relevant published data or appropriate tests. The tests should consider possible roughness, Keulegan-Carpenter and Reynolds numbers dependence.



a. Cylindrical chord members with protruding racks **(b) Triangular chord**

Figure 4.3.2 Type of chord

(b) **Dynamics**: Due account of dynamics is to be taken in computing leg stresses when this effect is significant. The following governing aspects are to be included:

(i) The mass and mass distribution of the unit. This includes structural mass, mass of equipment and variable load on board, added mass due to the surrounding water and marine growth, if applicable, etc.
(ii) The global unit structural stiffness. This includes stiffness contributions from the leg to hull connections and the footing interface, if applicable.
(iii) The damping. This includes structural damping, foundation soil damping and hydrodynamic damping.
(iv) Fixity condition at bottom of leg.

~~(c) **Other considerations**: Other considerations in computing leg stresses include:~~
~~(i) Forces and moments due to initial leg inclination and lateral frame deflections of the legs.~~
~~(ii) Bending moments at leg/hull connections due to hull sagging under gravity loads.~~

(c) **P-Δ effect**: Due accounts to be taken in computing leg stresses include:

(i) Forces and moments due to initial leg inclination and leg-hull clearances. Total horizontal offset should be taken as 0,5 per cent of the leg length below the lower guide, unless otherwise specified.
(ii) Forces and moments due to lateral frame deflections of the legs under the wind, wave and current loads including the dynamic effects.
(iii) Euler's non-linear amplification factor.

(d) **Hull deflection:** Bending moments at leg/hull connections due to hull sagging under gravity loads.

3.10 Legs in field transit conditions

3.10.1 In field transit conditions within the same geographical area, legs are to be designed for acceleration forces caused by a 6° single amplitude of roll or pitch at the natural period of the unit, plus, 120 per cent of the gravity forces caused by the legs' angle of inclination, unless otherwise verified by appropriate model tests or calculations. ~~The legs are to be investigated for any proposed leg arrangement with respect to vertical position during field transit moves, and the approved positions are to be specified in the Operations Manual. Such investigation is to include strength and stability aspects. Field transit moves may only be undertaken when the predicted weather is such that the anticipated motions of the unit will not exceed the design condition.~~

3.10.2 The legs are to be investigated for any proposed leg arrangement with respect to vertical position during field transit moves, and the approved positions are to be specified in the Operations Manual. Such investigation is to include strength and stability aspects. Field transit moves may only be undertaken when the predicted weather is such that the anticipated motions of the unit will not exceed the design condition.

Existing paragraph 3.10.2 has been renumbered 3.10.3.

3.10.4 Where a special leg position is required for field moves, this position is to be specified in the Operations Manual.

3.11 Leg in ocean transit conditions

3.11.1 In ocean transit conditions involving a move to a new geographical area, legs are to be designed for acceleration and gravity loadings resulting from the motions in the most severe anticipated environmental transit conditions, together with corresponding wind moments. ~~Calculation or model test methods may be used to determine the motions. Alternatively, legs may be designed for the acceleration and gravity forces caused by a design criterion of 20° single amplitude of roll or pitch at a 10 second period. For ocean transit conditions, it may be necessary to reinforce or support the legs, or to remove sections of them. The approved condition is to be included in the Operations Manual.~~

3.11.2 Calculation or model test methods may be used to determine the motions. Alternatively, legs may be designed for the acceleration and gravity forces caused by a design criterion of 20° single amplitude of roll or pitch at a 10 second period. For ocean transit conditions, it may be necessary to reinforce or support the legs, or to remove sections of them.

3.11.3 The approved condition is to be included in the Operations Manual.

3.13 ~~Stability~~ Overturning stability in-place

3.13.1 When the legs are resting on the sea bed, the unit is to have sufficient positive downward gravity loadings on the support footings or mat to withstand the overturning moment of the combined environmental and functional forces from any direction, with a reserve against the loss of positive bearing of any footing or segment of the area, for ~~each design loading~~ the elevated conditions. ~~The most critical minimum variable load condition is to be considered for each loading direction and in no case is the variable load to be taken greater than 50 per cent of the maximum and using the least favourable location of the centre of gravity.~~

3.13.2 The anticipated minimum variable load is to be considered for each loading direction and, for the overturning calculation, in no case is the variable load to be taken greater than 50 per cent.

~~3.13.2~~ 3.13.3 The safety factor against overturning is to be at least 1,25 with respect to the rotational axis through the centres of the independent footings at the seabed. For a unit with a mat type footing, the rotational axis is to be taken at the maximum stressed edge of the mat.

$$1{,}25 \leq \frac{M_s}{M_o}$$

where

M_s = stabilising moment due to the effects of weight and variable load
M_o = overturning moment due to the effects of wind, wave, current, dynamic amplification, P-Δ, and crane operation

3.13.4 For self-elevating units with independent footings, it is assumed that the vertical point of axis of rotation at each footing is situated at a distance above the spudcan tip equivalent to the lesser of:

- Half the maximum predicted penetration; and
- Half the height of the spudcan.

Existing paragraph 3.13.3 has been renumbered 3.13.5.

3.15 Foundation fixity

3.15.2 For in-place analysis, the leg to spudcan connections and the lower parts of the leg with independent footings are to be designed for a leg moment no less than 50 per cent of the maximum leg moment at the lower guides (assuming a pinned footing), together with the associated horizontal and vertical loads.

3.15.3 The assumed reaction point at the spudcan is to be in accordance with *Pt 4, Ch 4, 3.13 Overturning stability in place*.

3.17 Independent footings and interfaces with legs

3.17.1 Independent footings and the leg to footing connections are to be designed to withstand the most severe combination of overall and local loadings to which they may be subjected, *see also Pt 4, Ch 4, 3.16 Bottom mat 3.16.3*. In general, the primary structure of the footings, the lower part of the legs, and the leg to footing connections are~~is~~ to be analysed by a three-dimensional finite element method.

3.17.2 The complexity of the mathematical model together with the associated element types is to be sufficiently representative of all parts of the primary structure to enable internal stress distributions to be established. A local model may be developed for yield and buckling assessment and should be extended vertically to at least two bays above the top of the footing.

3.17.3 The loading combinations considered are to represent all elevated conditions ~~modes of operation~~ so that the critical design cases are established, and are to include, but not be limited to, the following:
(a) The maximum preload concentrated or distributed over the area of initial contact.
(b) The maximum preload uniformly distributed over the entire bottom area.
(c) The relevant preload distributed over contact areas corresponding to intermediate levels of penetration, as required.
(d) The greatest leg load due to the specified environmental maxima applied over the entire bottom area, with the pressure varying linearly from zero at one end to twice the mean value at the other end.

(e) The distribution in *Pt 4, Ch 4, 3.17 Independent footings 3.17.3* applied in different directions, depending on structural symmetry, to cover all possible wave headings.
(f) Where it is intended to move the unit without the footings being fully retracted, a special analysis of the leg to spudcan connections may be required.

3.17.9 Fatigue analysis at the leg to footing connections is to be performed and submitted for review.

3.18 Life boat platforms

3.18.1 When self-elevating units are fitted with cantilevered lifeboat platforms, the strength of the platforms is to comply with *Pt 4, Ch 4, 1.9 Lifeboat platforms*. ~~If the lifeboat platform can be subjected to wave impact forces in transit conditions, the scantlings are to be specially considered and details are to be submitted for consideration by LR.~~

3.18.2 If the lifeboat platform may be subject to wave impact forces in transit conditions, the scantlings are to be specially considered and details are to be submitted for review.

Part 4, Chapter 6
Local Strength

■ *Section 3*
Watertight shell boundaries

3.3 Self-elevating units

(Part only shown)

Table 6.3.1 Watertight shell boundaries for lower hulls and columns of column-stabilised units and tension-leg units

Items and requirement	Boundaries of lower hull or columns
1. Shell plating thickness *See also Pt 4, Ch 6, 3.1 General 3.1.5*	$t = 0{,}004s\text{-}f\sqrt{h_o k}$ mm but $t + tc$ not less than 7,5 mm

(Part only shown)

Table 6.3.2 Watertight shell boundaries of the upper hull of column-stabilised units and tension-leg units

Items and requirement	Boundaries of upper hull
(1) Shell plating thickness general *See also Pt 4, Ch 6, 3.1 General 3.1.5*	The greater of the following: b. $t = 0{,}00sf\sqrt{h_4 k}$ mm c. $t = 0{,}012s_1\sqrt{k}$ but $t + tc$ not less than 7,5 mm
(2) Bottom plating thickness between columns within $\frac{W}{2}$ outside of column shell but not less than two web frame spaces *See also Pt 4, Ch 6, 3.1 General 3.1.5*	The greater of the following: (a) $t = 0{,}00s\text{-}f\sqrt{h_4 k}$ mm (b) $t = 0{,}012s_1\sqrt{k}$ but $t + tc$ not less than 7,5 mm

3.4 Buoys and deep draught caissons

(Part only shown)

Table 6.3.3 Shell plating self-elevating units

Location	Thickness, in mm, *see also Pt 4, Ch 3, 3.1 General 3.1.5*
(1) Bottom shell plating *See ~~Notes~~* Notes 1 and 3	$t = 0{,}0033s_1\sqrt{1{,}5T_T k}$ but $t + tc$ not less than 7,5 mm

(Part only shown)

Table 6.3.5 Watertight shell boundaries of buoys and deep draught caissons

Items and requirement	Shell boundaries, *see* Note 5
(1) Shell plating thickness	$t = 0{,}004sf\sqrt{h_o k}$ mm

See also *Pt 4, Ch 6, 3.1 General 3.1.5*	but *t* + *tc* not less than 7,5 mm

■ *Section 4*
Decks

4.3 Deck stiffening

(Part only shown)

Table 6.4.1 Deck plating

Symbols	Location	Thickness, in mm, *see also Pt 4, Ch 6, 4.2 Deck plating*
b = breadth of increased plating, in mm	(2) Lower decks	$t = 0{,}0012 s_1 \sqrt{k}$ but *t* + *tc* not less than 7,0 mm
	(3) Platform decks	$t = 0{,}0012 s_1 \sqrt{k}$ but *t* + *tc* not less than 6,5 mm
	(4) in way of the crown or bottom of tanks	$t = 0{,}004 sf \sqrt{\frac{\rho k h_4}{1{,}025}}$ or as (1), (2) or (3) whichever is the greater but *t* + *tc* not less than 7,5 mm

■ *Section 7*
Bulkheads

7.3 Watertight and deep tank bulkheads

(Part only shown)

Table 6.7.1 Watertight and deep tank bulkhead scantlings

Item and requirement	Watertight bulkheads	Deep tank bulkheads
(1) Plating thickness for plane, symmetrically corrugated and double plate bulkheads	$t = 0{,}004 sf \sqrt{h_4 k}$ mm but *t* + *tc* not less than 5,5 mm	$t = 0{,}004 s\text{-}f \sqrt{\frac{\rho h_4 k}{1{,}025}}$ mm ~~Nor~~ but *t* + *tc* not less than 7,5 mm

7.3.9 Wash bulkheads or divisions are to be fitted to deep tanks as required by *Pt 4, Ch 7, 4 Watertight integrity*. The division bulkhead may be intact or perforated as desired. If intact, the scantlings are to be as required for boundary bulkheads. If perforated, the gross plating thickness is not to be less than 7,5 mm and the modulus of the stiffeners may be 50 per cent of that required for boundary bulkheads, using h_4 measured to the crown of the tank. The stiffeners are to be bracketed at top and bottom. The area of perforation is to be not less than five per cent nor more than 10 per cent of the total area of the bulkhead. Where brackets from horizontal girders on the boundary bulkheads terminate at the centreline bulkhead, adequate support and continuity are to be maintained.

■ *Section 8*
Double bottom structure

8.3 Self-elevating units

8.3.4 **The centre girder** is to have a depth of not less than that given by:

$$d_{\mathrm{DB}} = 28B + 205\sqrt{T_{\mathrm{T}}}\ \mathrm{mm}$$

nor less than 760 mm. The centre girder thickness is to be not less than:

$$t = (0{,}008 d_{\mathrm{DB}} + 4)\sqrt{k}\ \mathrm{mm}$$

nor is $t + t_c$ to be less than 6,0 mm. The thickness may be determined using the value for d_{DB} without applying the minimum depth of 760 mm.

8.3.5 **Side girders** are to be fitted below longitudinal bulkheads. In general, one side girder is to be fitted where the breadth, *B*, exceeds 14 m and two side girders are to be fitted on each side of the centreline where *B* exceeds 21 m. Equivalent arrangements are to be provided where longitudinal bulkheads are fitted. The side girders are to be extended as far forward and aft as practicable and are to have a thickness not less than:

$$t = (0{,}0075d_{\mathrm{DB}} + 1)\sqrt{k}\ \mathrm{mm}$$

nor is $t + t_c$ to be less than 6,0 mm. In general, a vertical stiffener, having a depth not less than 100 mm and a thickness equal to the girder thickness, is to be arranged midway between floors.

8.3.10 **Inner bottom plating** is, in general, to have a thickness not less than:

$$t = 0{,}00136(s + 660)(k^2 L T_{\mathrm{T}})^{1/4}\ \mathrm{mm}$$

nor is $t + t_c$ to be less than 6,5 mm.

8.3.11 The thickness, t, of the inner bottom plating as defined in *Pt 4, Ch 6, 8.3 Self-elevating units 8.3.10* is to be increased by 10 per cent in machinery spaces but in no case is the gross thickness ($t + t_c$) to be less than 7,0 mm.

8.3.15 **Plate floors** are to be fitted under heavy machinery items and under bulkheads and elsewhere at a spacing not exceeding 3,8 m. The thickness of non-watertight plate floors is to be not less than:

$$t = (0{,}009d_{\mathrm{DB}} + 1)\sqrt{k}\ \mathrm{mm}$$

nor is $t + t_c$ to be less than 6,0 mm. The gross thickness need not be greater than 15 mm, but the ratio between the depth of the double bottom and the thickness of the floor is not to exceed $130\sqrt{k}$. This ratio may, however, be exceeded if suitable additional stiffening is fitted. Vertical stiffeners are to be fitted at each bottom shell stiffener, having a depth not less than 150 mm and a thickness equal to the thickness of the floors. For units of length, L, less than 90 m, the depth is to be not less than 1,65L mm, with a minimum of 50 mm.

8.3.16 **Watertight floors** are to have thickness not less than:

(a) $t = (0{,}008d_{\mathrm{DB}} + 3)\sqrt{k}\ \mathrm{mm}$, or
(b) $t = (0{,}009d_{\mathrm{DB}} + 1)\sqrt{k}\ \mathrm{mm}$,

Whichever is the greater, but $t + t_c$ is not to exceed 15 mm on floors of normal depth. The thickness is also to satisfy the requirements for deep tanks, *see Pt 4, Ch 6, 7.3 Watertight and deep tank bulkheads*, with the load head h_4 measured to the highest point of the side tank or cofferdam if the double bottom tank is interconnected with these tanks. The scantlings of the stiffeners are to be in accordance with the requirements of *Pt 4, Ch 6, 7.3 Watertight and deep tank bulkheads* for deep tanks, but in no case is the modulus to be less than:

$$Z = 5{,}41 d_{\mathrm{DBA}}^2 h_{\mathrm{DB}} s k \times 10^{-9}\ \mathrm{cm}^3$$

Vertical stiffeners are to be connected to the inner bottom and shell stiffeners.

8.3.18 Where floors form the boundary of a sea inlet box, the thickness of the plating is to be the same as the adjacent shell, but $t + t_c$ is not to be less than 12,5 mm. The scantlings of stiffeners, where required are, in general, to comply with *Pt 4, Ch 6, 7.3 Watertight and deep tank bulkheads* for deep tanks. Sniped ends for stiffeners on the boundaries of these spaces are to be avoided wherever practicable. The stiffeners should be bracketed or the free end suitably supported to provide alignment with backing structure.

■ *Section 9*
Superstructures and deck-houses

9.5 Bulkhead plating and stiffeners

9.5.1 The plating thickness, t, of fronts, sides and aft ends of all erections other than the sides of the superstructures where these are an extension of the side shell, is not to be less than:

$$t = 0{,}003s\sqrt{kh}\ \mathrm{mm}$$

but in no case is the thickness to be less than:

(a) for the lowest tier:

$$t = (5{,}0 + 0{,}01L_3)\sqrt{k}\ \mathrm{mm}$$

but $t + t_c$ not less than 5,0 mm.

(b) for the upper tier:

$t = (4{,}0 + 0{,}01L_3)\sqrt{k}$ mm

but $t + t_c$ not less than 5,0 mm.

9.6 Erections on self-elevating units

9.6.2 The plating thickness, *t*, of exposed lower tier fronts is to be not less than:

$t = 0{,}0036s\sqrt{kh}$ mm

but in no case is the gross thickness $t + t_c$ to be less than 7,0 mm.

9.7 Erections on other unit types

9.7.2 When the erection is not subjected to wave forces in any condition then the structure is to be suitable for the maximum design loadings but the minimum scantlings of exposed sides and ends of all erections is to be not less than:

(a) for the lowest tier:

$t = (5{,}0 + 0{,}01L)\sqrt{k}$ mm

but $t + t_c$ not less than 5,0 mm.

(b) for the upper tiers:

$t = ($~~$5{,}0$~~ $4{,}0 + 0{,}01L)\sqrt{k}$ mm

but $t + t_c$ not less than 5,0 mm.

9.8 Deck plating

9.8.3 When decks are fitted with approved sheathing, the net thickness derived from *Table 6.9.5 Thickness of deck plating* may be reduced by 10 per cent for a 50 mm sheathing thickness, or five per cent for 25 mm, with intermediate values in proportion. The steel deck is to be coated with a suitable material in order to prevent corrosive action, and the sheathing or composition is to be effectively secured to the deck. Inside erections the net thickness may be reduced by a further 10 per cent. In no case is the deck gross thickness to be less than 5,0 mm.

9.13 Aluminium erections

9.13.2 The thickness, *t*, of aluminium alloy members is to be not less than:

$t = 2{,}5 + 0{,}022d_W$ mm but $t + t_c$ need not exceed 10 mm

where

d_W = depth of the section, in mm

Part 6, Chapter 2
Electrical Engineering

■ *Section 7*
Switchgear and ~~control gear~~ controlgear assemblies

7.5 Creepage and clearance distances

(Part only shown)

7.5.3 For assemblies with a rated voltage above 1kV, the requirement of *Pt 6, Ch 2, 7.5 Creepage and clearance distances 7.5.1* of the ~~Rules of Ships~~ *Rules and Regulations for the Classification of Ships* may be met by complying with IEC 60092-503, *Electrical installations in ships – Part 503: Special features – AC supply systems with voltages in the range of above 1kV up to and including* ~~*15*~~ *36kV*.

Part 7, Chapter 1
Safety and Communication Systems

■ *Section 2*
Fire and gas alarm indication and control systems

2.10 Fire and gas detection systems for drilling areas on mobile offshore drilling units

2.10.8 The number and position of utilised gas detectors is to ensure an appropriate coverage of the hydrocarbon leak risks associated with the ~~process module~~ drilling facilities.

2.10.10 For mobile offshore drilling units, fixed automatic combustible gas detection and alarm systems are to be provided for the following areas:
(a) Cellar deck;
(b) Drill floor;
(c) Ventilation intake of positive pressure explosion-proof driller's cabin or local equipment rooms etc.;
(d) Mud pit area;
(e) Shale shaker area;
(f) Enclosed spaces containing the open components of mud circulation system from the bell nipple to the mud pits;
(g) Ventilation intakes of accommodation spaces;
(h) Ventilation intakes of enclosed machinery spaces contiguous to hazardous areas and containing internal combustion engines, boilers, or non-explosion proof electrical equipment, for example, such equipment in local equipment rooms etc.;
(i) Air intakes to all combustion engines or machinery, including internal combustion engines, boilers, compressors or turbines, located outside of an enclosed machinery space;
(j) At each access door to accommodation spaces; and
(k) Near other openings, including emergency egress, of accommodation spaces, regardless of whether these openings are fitted with self-closing and gastight closing appliances.

2.10.11 For mobile offshore drilling units, fixed automatic combustible gas detection and alarm systems are not required:
(a) Near access doors to accommodation spaces where these form part of an air lock which is provided with a gas detection and alarm system between the two doors of the air lock;
(b) Near emergency egress doors which are fitted with a mechanism to prevent use other than in an emergency (e.g. doors fitted with security seals acting as a deterrent but easily breakable in a real emergency.); and
(c) Near other openings which are provided with closing appliances of non-opening type, e.g. bolted closed maintenance ways etc.

2.10.12 For mobile offshore drilling units, fixed automatic hydrogen sulphide gas detection and alarm systems are to be provided for the following areas:
(a) Drill area;
(b) Mud processing area; and
(c) Well test area.

2.10.13 The hydrogen sulphide detection and alarm system is to clearly indicate where gas has been detected, with the low level alarm indication set at 10 ppm hydrogen sulphide.

Part 7, Chapter 3
Fire Safety

■ *Section 3*
Additional requirements for units with drilling and/or production and process plant or pipe-laying system

3.1 General requirements for fire-water mains and pumps

3.1.2 The arrangements of the pumps, sea suctions and sources of power are to be such as to ensure that a fire, explosion, gas release, flood or any other credible significant event in any one space would not put more than one required pumping unit out of action. There are to be at least two water supply sources (sea chests, valves, strainers and pipes, firewater pump risers directly from the sea) provided and so arranged that one supply source failure will not put all supply sources out of action dependent upon the requirements of *Pt 7, Ch 3, 3.3 Fire pumps 3.3.10* with regards to firewater pump redundancy.

3.7 Other fixed fire-extinguishing systems

3.7.4 Where a low-pressure CO_2 system is fitted, the piping system is to be designed in such a way that the CO_2 pressure at the nozzles is not less than 1 N/mm^2.

Existing paragraph 3.7.4 has been renumbered 3.7.5.

Part 10, Chapter 1
General Requirements

■ *Section 5*
Structural design – New-build units

5.2 Hull scantlings

5.2.2 When the site-specific wave bending moments and shear forces are below the values for unrestricted worldwide transit, the site-specific values may generally be used for design, *see Pt 10, Ch 1, 5.1 General 5.1.4*. However, in no case are the site-specific wave bending moments and shear forces for on-site operation and transit to be taken as less than 50 per cent of the value for unrestricted worldwide transit.

■ *Section 6*
Structural design – Tanker conversions

6.2 Hull scantlings

6.2.2 When the site-specific wave bending moments and shear forces are below the values for unrestricted worldwide transit, the site-specific values may generally be used for design, *see Pt 10, Ch 1, 6.1 General 6.1.4*. However, in no case are the site-specific wave bending moments and shear forces for on-site operation and transit to be taken as less than 50 per cent of the value for unrestricted worldwide transit.

Part 10, Chapter 2
Loads and Load Combinations

■ *Section 3*
Dynamic load components

3.4 Return periods and probability factor, f_{prob}

3.4.2 In no case are the environmental loads used for the assessment of the hull structure for on-site operation~~, inspection/ maintenance~~, restricted service area transit~~,~~ and delivery voyage ~~and flooding~~ to be less than 50 per cent of the 25-year return period dynamic loads defined for unrestricted worldwide transit service.

Section 6
Combination of loads

6.1 Symbols

(Part only shown)

Table 2.6.1 Design load combinations

Local loads										
Load component		Space type	Operation on-site		Inspection/maintenance		Transit		Flooded	
			S	S+D	S	S+D	S	S+D	S	S+D
Liquid pressure	P_{in}	Ballast tanks	$P_{in-air} + P_{drop}$	$P_{in-tk} + P_{in-dyn}$	$P_{in-test}$	~~$P_{in-test}$~~ $P_{in-tk} + P_{in-dyn}$	$P_{in-air} + P_{drop}$	$P_{in-tk} + P_{in-dyn}$	$P_{in-flood}$	max ~~$(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$~~ $(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$
		Cargo tanks/ other tanks designed for liquid filling	$P_{in-tk} + P_{valve}$	$P_{in-tk} + P_{in-dyn}$	max ~~$(P_{in-tk} + P_{valve}, P_{in-test})$~~ $(P_{in-tk} + P_{valve}, P_{in-test})$	~~$P_{in-test}$~~ $P_{in-tk} + P_{in-dyn}$	$P_{in-tk} + P_{valve}$	$P_{in-tk} + P_{in-dyn}$	$P_{in-flood}$	max ~~$(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$~~ $(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$
		Fresh water and fuel/ lube oil tanks	P_{in-air}	$P_{in-tk} + P_{in-dyn}$	$P_{in-test}$	~~$P_{in-test}$~~ $P_{in-tk} + P_{in-dyn}$	P_{in-air}	$P_{in-tk} + P_{in-dyn}$	$P_{in-flood}$	max ~~$(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$~~ $(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$
		Water tight boundaries/void spaces			$P_{in-test}$	~~$P_{in-test}$~~ $P_{in-tk} + P_{in-dyn}$			$P_{in-flood}$	max ~~$(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$~~ $(P_{in-tk}, P_{in-flood}) + P_{in-dyn}$

Part 12, Chapter 1
Recognised Codes and Standards

■ *Section 23*
Lifting appliances

23.1 Recognised codes and standards for lifting appliances

23.1.1 The following codes and standards are recognised by LR:

(Part only shown)

LR's Code for Lifting Appliances in a Marine Environment
LR's Code for Offshore Personnel Transfer Systems

© Lloyd’s Register Group Limited 2022
Published by Lloyd’s Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom

Lloyd’s Register and variants of it are trading names of Lloyd’s Register Group Limited, its subsidiaries and affiliates. For further details please see http://www.lr.org/entities

Lloyd's Register Group Limited, its subsidiaries and affiliates and their respective officers, employees or agents are, individually and collectively, referred to in this clause as ‘Lloyd's Register’. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.